Relationship of Morphological Traits and Seed Yield of Plain Rough Fescue Grass (*Festuca hallii* (Vasey) Piper) with Different Origins

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Abstract

Seed production in plains rough fescue (*Festuca hallii* (Vasey) Piper) is infrequent and unpredictable. The objective of this study was to compare seed yield of plain rough fescue collections and to determine correlation between phenotypic characteristics and seed yield. In 2006, a field nursery was established from 11 collections of plain rough fescue grass at the Semiarid Prairie Agricultural Research Centre near Swift Current (50°25' N, 107°44' W), Canada. Plot design was a randomized complete block design with three replications. Six phenotypic variables were measured in summer 2010. Seed yield varied among collection sites. Plant vigour rating (r=0.29, $P<0.01$) and number of reproductive tiller (r=0.47, $P<0.01$) were positively correlated to individual plant seed yield, while reproductive tiller height (r=-0.47, $P<0.01$) and crown width (r=0.62, $P<0.01$) were negatively correlated to seed yield. Individual plant biomass didn't have any correlation with seed yield. Selecting vigorous individual plant with higher number of reproductive tillers may improve seed yield of rough fescue grass.

Introduction

Plains rough fescue (*Festuca hallii* (Vasey) Piper) is a dominant grass in the Fescue Prairie of North America. Seed production in plains rough fescue is infrequent and unpredictable (Johnston and MacDonald, 1967). Genetic improvement of seed production would be important for commercial seed production for rangeland re-seeding and reclamation. Considerable range of genetic variability for selection exists both within and among populations of rough fescue (May et al. 2003). However, there is no known trait for selection of improved seed production. In alpine rough fescue (*Festuca ataica* Trin.), the greater investment of individual tiller mass is positively related to flower development (King et al. 1998). May et al. (2003) suggested that the initial selection of plants with inflorescence may have biased selection for seed yield increase. The objective of this study was to test seed yield variation among collections and also assess the correlation between individual plants morphological trait and seed yield.

Materials and method

Seeds of plain rough fescue were collected from 11 sites in Saskatchewan, Canada. Two cycles of selection were made on each collection based on fertile seed production, and the seed was harvested separately for each collection. In spring 2006, a field nursery was established using the 11 selected populations at the Semiarid Prairie Agricultural Research Centre near Swift Current

(50°25' N, 107°44' W). Plot Design was a randomized complete block design with three replications. Each replication had 297 individual plants or 27 plants from each population. We measured seed yield (g plant $^{-1}$), reproductive tiller height (cm), crown width (cm), plant biomass (g plant $^{-1}$), vigour rating (1, 2, 3 low-high), and reproductive tiller number (tiller plant $^{-1}$).

A one-way analysis of variance (ANOVA) was conducted to compare seed yield among the collections using the PROC MIXED procedure of SAS. The main effect was separated out using least square means comparison at the 0.05 level of significance. Pearson's correlation was calculated between individual plant seed yield and other measured variables.

Results and Discussion

There was a significant seed yield difference among the 11 collections. Collection No.8 produced the highest seed yield while collection No.10 produced the lowest. No significant difference of seed yield was found among the other 9 collections (Figure 1). The seed yield of individual plants was negatively correlated to plant crown width and reproductive tiller height (Figure 2 *a*-*b*), and was positively correlated to plant vigour rating and total reproductive tiller number (Figure 2 *c*-*d*) (P<0.05). However, there was no significant correlation between individual plant above-ground biomass and seed yield (P>0.05) (Figure 2 *e*).

The higher seed yield of collection No. 8 indicates the potential for further selection. However, environmental condition is expected to influence rough fescue grass seed production. Flowering in rough fescue is sporadic among years and sparse even with optimal conditions. Therefore, the initial selection of plants with inflorescence may have biased selection for those with a greater tendency to flower (May et al 2003). Further assessment of seed yield and other variables will be necessary under different environments over a few years.

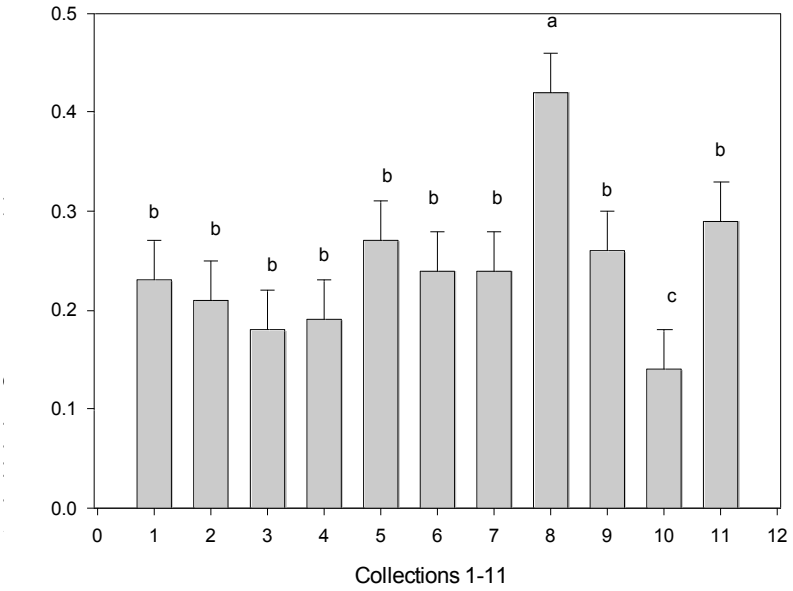

Figure 1. Seed yield comparison of 11 plain rough fescue grass collections in summer 2010 near Swift Current, SK.

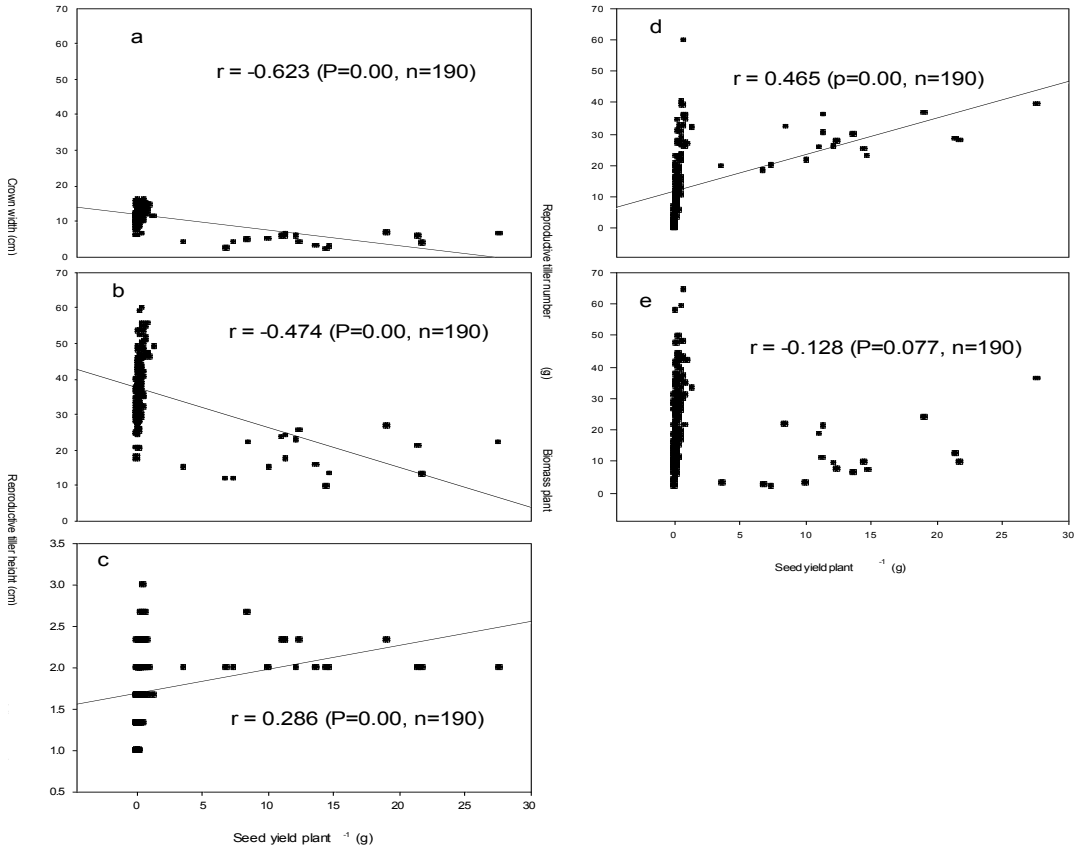

Figure 2 *a-e*. Pearson's correlation between seed yield and tiller biomass, reproductive tiller number, plant vigour, reproductive tiller height, and crown width of *Festuca hallii.*

Preliminary Conclusion

Seed yield varied among collection sites, and collection No.8 had the potential for further selection for a higher seed yielding line. Plant vigour rating and number of reproductive tillers can be used to select higher seed yielding rough fescue population. Selection for higher seed yield may result in plants with narrower crown.

References

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